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INSTRUCTION GUIDE

FOR

REMEDIATION OF THE 100-BC-1, 100-DR-1, AND 100-HR-1 WASTE SITES

BHI-DIS 10/15/96 KW

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APPROVAL PAGE

Title of Document: FIELD INSTRUCTION GUIDE FOR THE REMEDIATION OF THE 100-BC-1, 100-DR-1, AND 100-HR-1 WASTE SITE

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The approval signatures on this page indicate that this document has been authorized for information release to the public through appropriate channels. No other forms or signatures are required to document this information release.

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1.0 PURPOSE

This Field Instruction Guide (FIG) provides direction to field analytical personnel for implementing the *100-BC-1, 100-DR-1, and 100-HR-1 Sampling and Analysis Plan* (SAP) (DOE-RL 1996). The SAP is the controlling document in performing work. All references to the SAP are italicized to distinguish SAP references from FIG references. This FIG will be revised as field conditions dictate or when upper-tier requirements in the SAP are changed. The FIG is issued and controlled as an instruction guide. All revisions to the FIG will be approved by the Resident Engineer using a Design Change Notice (DCN). The Resident Engineer for each of the remediation projects covered by the SAP will provide direction as needed, as described in this guide.

A Sample Authorization Form (SAF) will be prepared for each remedial action activity that provides analytical parameters, analytical methods, sample container type and volume, and holding time for each laboratory (Standard Fixed Laboratory [SFL], Quick Turnaround Laboratory [QTL]).

1.1 Responsibilities

<u>Resident Engineer</u> is responsible to plan and direct excavation guidance sampling/field screening events so that they are conducted prior to excavation with minimum interference to the excavation process.

<u>Samplers/Field Screeners</u> are responsible for maintaining training and qualifications and for conducting work in accordance with the Field Sampling Quality Management Plan (BHI 1996a), Onsite Measurements QA Plan (BHI 1996b), procedures, SAP, and this FIG. Samplers/Field Screeners will report results to the Resident Engineer daily and will immediately notify the Resident Engineer if action levels or trip points have been reached.

2.0 WASTE SITES

The waste sites are discussed in the SAP, and the contaminants of concern (COCs) are addressed under *Section I* of the SAP. Waste-site-specific COCs are listed in *Tables I-6a through I-6d* in the SAP. The COCs for the first six sites (SAP *Table II-2*) have been reviewed through the Data Quality Objective (DQO) process. The COCs for the remaining sites will undergo similar reviews and be updated as needed. Miscellaneous site-specific information and additional COCs not discussed in the SAP are included as Appendix B of this document.

Table 2-1 (corresponding to SAP *Table III-1*) provides the general sample locations, frequencies, and sampling methods. Sections 4.0 through 6.0 in this FIG describe how to perform sampling in accordance with this table. Functional tables providing specific information for sampling and analysis are also presented in Sections 4.0 through 6.0 of this FIG; these functional tables should be used for implementation.

Table 2-1. Sample Locations, Frequencies, Sampling Methods.[a]

Decision Objectives	Decision Boundaries	Physical Samples	
		# Samples	Sampling Methods
1. Excavation and Disposal	Per Section 4.0	As site warrants	Grab from backhoe or in the excavation
2. Overburden/ Layback	Table 5-1	4 composite samples: divide pile into 4 sections, collect 4 samples/quadrant and composite to 1 sample[b]	Composite
3a. Site Verification shallow (0-4.5 m [0-15 ft])	Table 5-1	4 composite samples, divide decision unit into 4 sections, collect 4 samples per section and composite to 1 sample per section[b]	Composite
3b. Site Verification (>4.5 m [>15 ft])	Table 5-1	3 composite samples, divide decision unit into 3 sections, collect 4 samples per section and composite to 1 sample per section	Composite
4. Backfill	Entire borrow pit	No samples	Radiation survey

[a] Table 2-1 is based on the DQO process for the first six 100-BC-1 waste sites to be remediated; additional parameters/uses/levels will be identified after future DQO processes for the remaining sites will be presented in page changes, addenda, or revisions as appropriate.
[b] Default plan - number of total samples may be revised per worksheet.

Site drawings showing excavation site boundaries should be obtained from the Resident Engineer. Once obtained, the drawing number, revision, and date shall be noted in the field logbook and should be the basis for all screening and sampling. Subsequent changes in drawings shall be logged.

3.0 SITE PREPARATION

Establish a sampling grid on the drawing over the waste site using Washington State Plane coordinates as a reference. The staking of the grid will be directed by the Resident Engineer.

If it is expected that the excavation surface will not be accessible after excavation is complete, refer to Section 5.0 of this FIG for instructions on determining verification sample locations **before excavation begins**.

4.0 FIELD MEASUREMENTS DURING EXCAVATION

The typical frequency and location requirements for field measurements taken to guide each phase of excavation are discussed in the following sections. However, if any of the following are observed during any phase of excavation, a systematic sampling approach shall be initiated to collect discrete samples:

- Health and safety action levels are approached (refer to site-specific health and safety plan and Radiation Work Permit)
- Visual anomalies are encountered
- Contaminant concentrations approach ERDF waste acceptance criteria (WAC) (see Table 4-2)
- Increase in contamination levels encountered determined by Field Screening that warrant sample collection, as determined by the Resident Engineer.
- Lack of data to support development of waste profile, as determined by Resident Engineer.

Notify the Resident Engineer immediately if one of the above-listed situations occurs or the action/trip levels listed in Table 4-2 are reached. The Resident Engineer may request additional field measurements and/or discrete sampling for analysis of COCs at the QTL. Actual sampling frequency/interval for this sampling event will be determined based on actual field conditions.

The laboratory-specific procedures for the QTL and the SFL will be referenced in the SAFs generated for each remedial action project to ensure consistency of methods used.

Table 4-1 (derived from SAP *Tables III-2a and III-3*) provides the quality control sampling requirements for discrete sampling during excavation. Field split samples should be collected from the same sample as field duplicates.

4.1 Frequency/Interval of Measurements

Refer to *Section III-2, Sampling Locations and Frequencies*, in the SAP for a general description of sample frequencies and sampling methods. Table 4-3 summarizes the frequency and method of field measurements for excavation, and Table 4-4 lists the Standard Operating Procedures (SOPs) for field instruments.

Table 4-1. Field Quality Control Requirements for Discrete Sampling During Excavation.

QC Sample Type	Frequency	Lab
Equipment Rinsates (Blanks)	1 sample per waste site.[a]	QTL
Field Duplicates	5% of all samples or a minimum of 1 sample per sampling unit.[b]	QTL
Field Splits	5% of all samples or a minimum of 1 sample per sampling unit.[b]	SFL
Field Blanks	1 sample per waste site.[a]	QTL
Blind Samples	Determined by Resident Engineer.	QTL

[a] Work sites as described in Section I-1 of the SAP.
[b] Sampling unit is the primary decision unit, such as the overburden/layback, deep zone, or shallow zone.

Table 4-2. Action Levels Triggering a Sampling Effort.[a]

COC	Field Instrument	ERDF WAC[e]	ERDF WAC Trip Levels[b]
Values below given in pCi/g			
^{241}Am	HPGe	30000	2 x Waste Profile
$^{60}Co/^{152}Eu$	NaI	NL[c]	2 x Waste Profile
^{60}Co	HPGe	NL[c]	2 x Waste Profile
^{137}Cs	NaI/HPGe	19000000	2 x Waste Profile
^{152}Eu	HPGe	1.26e+13	2 x Waste Profile
^{154}Eu	HPGe	NL[c]	2 x Waste Profile
^{155}Eu	HPGe	NL[c]	2 x Waste Profile
^{238}Pu	n/a[d]	902000	2 x Waste Profile
$^{239/240}Pu$	n/a[d]	17400	2 x Waste Profile
^{90}Sr	Beta	8.42e+09	2 x Waste Profile
^{238}U	Alpha	7220	2 x Waste Profile
Values below given in mg/kg			
Cr (Total)	XRF	59,000	2 x Waste Profile
Cr (VI)	HACH Test Kit	59,000	2 x Waste Profile
Hg	XRF	1,000	2 x Waste Profile
Pb	XRF	5,000	2 x Waste Profile
PCB	Immuno Assay	500	2 x Waste Profile

[a] When these trip levels are reached, systematic sampling can begin at the direction of the Resident Engineer. Additional information pertinent to selected COCs at specific sites is included in Appendix B.
[b] In addition to individual radioactive constituents concentrations, the "sum of fractions" method, as described in the ERDF WAC, shall also be addressed. Each radioactive constituent of concern in the waste must be divided by the appropriate limit from the ERDF WAC column, with the sum being less than or equal to 1.0, at a 95% level of confidence. Where there are two or more radioactive constituents present in a waste, the "sum of fractions" method (10 CFR 61.55) shall be used.
[c] ERDF WAC (Rev. 2) states NL = no limit required except as required by 10 CFR 61.
[d] n/a = no field instrument available to measure concentration.
[e] ERDF WAC limits are included for information because the action level (2 x waste profile) for some constituents may approach the ERDF WAC limits.

Table 4-3. Excavation Field Measurement Frequencies.

Analytical Parameters	Case A: Typical Excavation Guidance[a]	Case B: Excavating Through Overburden, Potentially Clean Material, and When Approaching RAGs	Method
	Routine Sample Frequency[b]		
COCs (Gamma)	50% Surface Coverage (NS or EW grid lines) (boundary)	50% Surface Coverage (NS or EW grid lines) (boundary)	NaI
COCs (Gamma)	20% Surface Coverage (NS or EW grid lines) (internal)	20% Surface Coverage (NS or EW grid lines) (internal)	NaI
COCs (Gamma Isotopes)	Minimum of 4 analyses/lift, and As Directed by the Resident Engineer	Refer to Section 5.1 and 5.2 (Shallow & Deep Zone Verification Sampling) and Section 6.1 (Overburden/Layback)	HPGe
COCs (Alpha, Beta)	As directed by the Resident Engineer	As directed by the Resident Engineer	GM, PAM
Metals	As directed by the Resident Engineer	As directed by the Resident Engineer	XRF

[a] Information taken from Table III-2a of the SAP.
[b] The values presented are starting points and may be adjusted up or down dependent on site conditions.

In order to ensure the indicated percentage coverage, use the following guidance for field measurements that will be used to guide excavation:

- 50% surface coverage for boundary

  Indicate on drawings the boundary grid lines to be surveyed to ensure 50% coverage. Perform gamma field surveys on the grid lines indicated on the drawing, as directed by the Resident Engineer. Measure metals concentrations and collect samples for gross alpha, beta analyses as directed by the Resident Engineer.

- 20% surface coverage of internal portion of waste site

  Indicate on drawings the interior grid lines to be surveyed to ensure 20% coverage. Perform gamma field surveys on the grid lines indicated on the drawing, as directed by the Resident Engineer. Measure metals concentrations and collect samples for gross alpha, beta analyses as directed by the Resident Engineer.

4.2 Procedures

Table 4-4 gives the standard operating procedures (SOPs) to be used for operating the field instruments. A controlled copy of each of the referenced procedures will be kept at the field site. In general, SOPs contained in BHI-EE-05 will be followed for field measurements.

Table 4-4. SOPs for Field Instruments.

Field Instrument	SOP
RCMS (includes NaI and HPGe)	BHI-EE-05 FSP 1.23, 1.24, 1.25
HPGe (If MRDS system is used)	BHI-SH-04 Procedure No. 13.1
MRDS (includes NaI)	BHI-SH-04 Procedure No. 7.4
GM, PAM[a]	BHI-SH-04 Procedure Nos. 3.1, 3.8
XRF	BHI-EE-05 FSP 2.0
Immuno Assay (PCB)	BHI-EE-05 FSP 1.9

[a] GM = Geiger-Mueller, PAM = Portable Alpha Monitor

4.3 Pre-Excavation Field Radiological Measurements

Perform pre-excavation field radiological measurements along 50% of the grid lines to generate a two-dimensional baseline map. The Resident Engineer will be responsible for decreasing or increasing the grid for future field measurements based on the pre-excavation data.

4.4 Field Measurements While Excavating Through Overburden

Resident Engineer will decide if adequate overburden exists for salvaging as backfill. If the overburden is to be excavated, perform field measurements as described in Table 4-3, Case B, through each excavation lift, and at the direction of the Resident Engineer. The actual boundaries of the overburden can then be determined.

4.5 Field Measurements While Excavating Through Shallow Zone

After overburden is removed, perform field measurements as described in Table 4-3, Case A, and at the direction of the Resident Engineer, while excavating through the shallow zone.

If field measurements indicate the material being surveyed is potentially clean, perform measurements as described for Case B, and at the direction of the Resident Engineer, so that it can be determined if the material should be layed back.

Additionally, if the field measurements indicate the excavation is nearly complete, i.e., the RAGs are being approached, perform measurements as described in Case B, and at the direction of the Resident Engineer, until it is determined if verification sampling can begin.

4.6 Field Measurements While Excavating Through Deep Zone

Perform field measurements as described in Table 4-3, Case A, and at the direction of the Resident Engineer, while excavating through the deep zone. Field measurements may be limited due to site logistical constraints.

If field measurements indicate the material being surveyed is potentially clean, perform measurements as described for Case B, and at the direction of the Resident Engineer, so that it can be determined whether the material should be layed back.

Additionally, if the field measurements indicate the excavation is nearly complete, i.e., the Remedial Action Goals (RAGs) are being approached, perform measurements as described in Case B, and at the direction of the Resident Engineer, until it is determined if verification sampling can begin.

5.0 VERIFICATION SAMPLING

The Resident Engineer will decide when the sodium iodide (NaI) detector data indicate that the RAGs have been met. Radiological data will then be collected with the HPGe detector to confirm the NaI detector measurements. If the HPGe data confirm the NaI detector data, verification samples will be collected. Refer to *Section I.4, Sampling and Analytical Strategies*, of the SAP for detailed discussion on the process flow.

Verification samples will be sent to the SFL for analysis of COCs. The sampling frequencies and locations, and procedures for shallow and deep zone verification sampling are described below.

Verification sampling is based on samples collected within decision units for each site. One primary decision unit is the exposed dig face and excavation floor between the original surface elevation and 15 ft below original ground surface (shallow zone). If the depth of the excavation is greater than 15 ft below the original surface elevation, this forms a second primary decision unit (deep zone). These primary decision units are broken into smaller units based on surface area, and the basis for the number of area-based subunits is summarized in Table 5-1. The area-based subunits were developed using *Table III-4, Size of Decision Units Relative to Size of Waste*

Sites, of the SAP. The numbers presented in Table 5-1 are intended to mitigate any rounding problems that may be occur if strictly following *Table III-4* of the SAP.

Table 5-1. Number of Decision Subunits Based on Area.

Area of Primary Decision Unit (ft^2)	Number of Subunits
<15,000	1
>15,000 to <25,000	2
>25,000 to <35,000	3
>35,000 to <45,000	4
>45,000 to <100,000	2
>100,000 to <140,000	3
>140,000 to <180,000	4
>180,000 to <220,000	5
>220,000	ROUND[a] (Area/40,000)

[a]ROUND is an integer rounding function.

For each site, it will be possible to plan the expected number of decision units and subunits based on the footprint area of the engineered structures and existing data. Sampling and analysis protocols will be identical for any decision subunits within the two primary decision units categories (shallow zone and deep zone).

Table 5-2 (derived from SAP *Tables III-2c and III-3*) provides the quality control sampling requirements for shallow-zone and deep-zone verification sampling. Field split samples should be collected from the same sample as field duplicates. This also applies if regulatory agencies collect split samples for their own analysis.

5.1 Shallow-Zone (0-4.5 m [0-15 ft]) Verification Sampling

Refer to *Section II.3.1.3.1, Shallow-Zone Verification*, of the SAP for detailed discussion on the development of shallow-zone verification sample strategy.

Table 5-2. Field Quality Control Requirements for Verification Sampling.

QC Sample Type	Frequency	Lab
Equipment Rinsates (Blanks)	1 sample per waste site.[a]	SFL
Field Duplicates	5% of all samples or a minimum of 1 sample per sampling unit.[b]	SFL
Field Splits	5% of all samples or a minimum of 1 sample per sampling unit.[b]	Split Lab
Field Blanks	1 sample per waste site.[a]	SFL
Blind Samples	Determined by Resident Engineer.	SFL

[a] Work sites as described in Section I-1 of the SAP.
[b] Sampling unit is the primary decision unit, such as the overburden/layback, deep zone, or shallow zone.

5.1.1 Frequency/Interval of Measurements

Section III-2 of the SAP summarizes the sample locations, frequencies, and sampling methods to be followed for shallow zone verification. The sections below describe how to implement the sampling frequencies and sampling methods described in *Table III-2c, Sampling Frequencies and Analytical Methods for Site Verification*, and *Table II-4, Summary of the Default Statistical Design for the Shallow-Zone Verification Decision Units*, of the SAP.

Two procedures are presented: Contingency A is to be used if the excavation surface is accessible after excavation is complete, and Contingency B is to be used if the excavation surface is not accessible after excavation is complete.

5.1.1.1. Contingency A. The excavation surface is accessible after excavation is complete. Follow the steps below.

Step 1: The Resident Engineer will determine the number of decision subunits based on Table 5-1 and surface area of the shallow zone.

Step 2: The Resident Engineer will divide the shallow zone into equal area subunits based on the number determined in step 1 (refer to Figure 5-1 for example).

Step 3: The Resident Engineer will divide each subunit into four equal-area sampling areas. Where practical, the Resident Engineer will use the random number table, provided in Appendix A, to select 6 sampling locations for each sampling area from a 16-node, equally spaced two-dimensional grid. For example, the subunit area is 10,000 ft^2, and the dimensions are 100 by 100 ft. A 16-node grid would have a 25-ft spacing in each direction to cover this area. The spacing for other sized sampling areas is derived from the area of the subunit divided by 16. For example, an 800-ft^2 area will have 16 50-ft^2 sampling locations. The staking of the grid will be directed by the Resident Engineer.

Step 4: Collect HPGe data at each of the six locations in each of the four sampling areas. If the data confirm the NaI detector data, the Resident Engineer will plug this data into the worksheet contained in *Appendix A* of the SAP.

Step 5: The Resident Engineer will calculate the required number of composite samples (which equates to the number of sampling areas) to collect in accordance with the worksheet. If the number of composite samples is greater than the default number of composite samples (four), the Resident Engineer will follow the procedure in *Appendix A* of the SAP to perform a cost comparison to determine the appropriate number of composite samples to collect.

Step 6: If it is determined in step 5 more than four samples are to be collected, the Resident Engineer will divide each of the decision subunits into the required number of areas (same as number of required composite samples calculated). Otherwise, the same four sampling areas established in step 3 will be used. Where practical, the Resident Engineer will use a random number table and select four of the six sampling locations selected in step 3. (**Note**: Using four of the six locations, rather than randomly selecting four <u>separate</u> locations, may be useful for correlation data.)

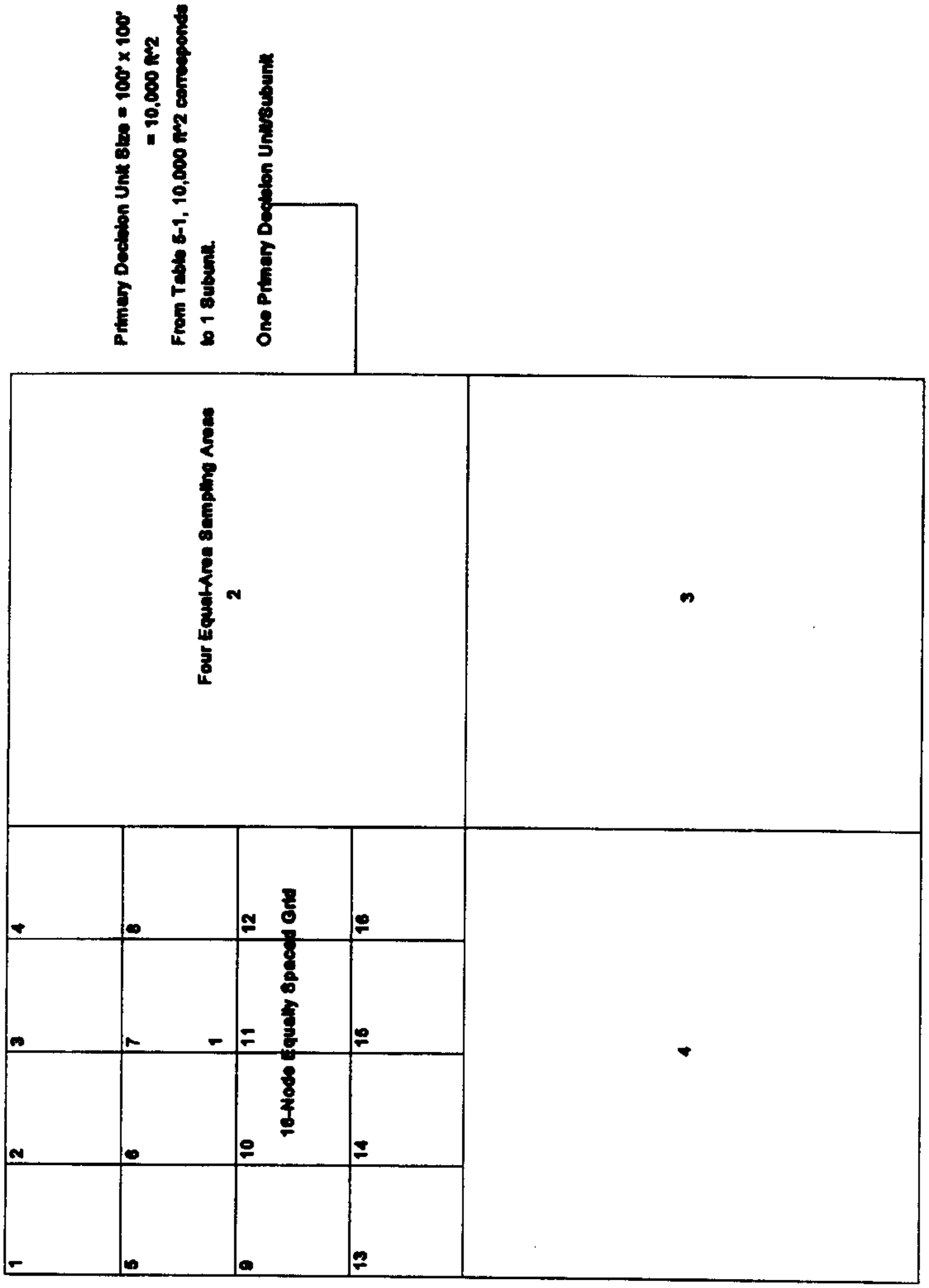
Step 7: From each of the selected four sampling locations in each sampling area, collect a grab sample to form a four-sample composite.

Result: Four (or number determined in step 5) composite samples for each decision subunit, where four locations are sampled for each composite sample. Attainment of closeout will be based on statistics calculated for these composite samples in each decision subunit.

5.1.1.2. Contingency B. The excavation surface is not accessible after excavation is complete. Perform steps 1 through 3 **<u>before excavation begins</u>**.

Step 1: The Resident Engineer will plan the expected area of the shallow zone before excavation begins. The Resident Engineer will determine the number of decision subunits based on Table 1 and expected surface area of the shallow zone.

Figure 5-1. Example of Decision Unit Division in Support of Statistical Sampling.



Step 2: The Resident Engineer will divide the expected shallow zone into equal-area subunits based on the number determined in step 1 (refer to Figure 5-1 for example).

Step 3: The Resident Engineer will divide each subunit into four equal-area sampling areas. **Before excavation begins**, the Resident Engineer will use the random number table, provided in Appendix A, to select six sampling locations for each sampling area from a 16-node, equally spaced two-dimensional grid. For example, the subunit area is 10,000 ft^2, and the dimensions are 100 by 100 ft. A 16-node grid would have a 25-ft spacing in each direction to cover this area. The spacing for other sized sampling areas is derived from the area of the subunit divided by 16. For example, an 800-ft^2 area will have 16 50-ft^2 sampling locations.

Although the sampling grid is in two dimensions, the depth of planned sample locations needs to be determined prior to excavation. The staking of the grid will be directed by the Resident Engineer.

Step 4: Collect a grab sample (for later compositing) and collect HPGe data at each of the six planned sampling locations in each of the four sampling areas **during excavation**. If the HPGe data confirm the NaI detector data, the Resident Engineer will determine verification samples can be composited. Otherwise, further excavation may be required; repeat steps 1 through 3. Once the Resident Engineer determines verification sample analysis is required, the Resident Engineer will use a random number table and select four sampling locations from the six selected in step 3. (**Note**: Using four of the six locations, rather than randomly selecting four separate locations, may be useful for correlation data.

Step 5: Composite the selected four grab samples from each sampling area.

Result: Four composite samples for each decision subunit, where four locations are sampled for each composite sample. Attainment of closeout will be based on statistics calculated for these composite samples in each decision subunit.

5.1.2 Procedures

Follow SOPs found in BHI-EE-01, Environmental Investigations Procedures, for verification sampling. A controlled copy of the referenced procedures will be kept at the field site.

5.2 Deep-Zone (>4.5 m [>15 ft]) Verification Sampling

Refer to *Section II.3.1.3.2, Deep-Zone Verification*, of the SAP for detailed discussion on the development of verification sample strategy.

5.2.1 Frequency/Interval of Measurements

Section III-2 of the SAP summarizes the sample locations, frequencies, and sampling methods to be followed for deep zone verification. The sections below describe how to implement the sampling frequencies and sampling methods described in *Table III-2c, Sampling Frequencies and Analytical Methods for Site Verification*, and *Table II-5, Summary of the Default Statistical Design for the Deep-Zone Verification Decision Units*, of the SAP.

Two procedures are presented: Contingency A is to be used if the excavation surface is accessible after excavation is complete, and Contingency B is to be used if the excavation surface is not accessible after excavation is complete.

5.2.1.1. Contingency A. The excavation surface is accessible after excavation is complete. Follow the steps below.

Step 1: The Resident Engineer will determine the number of decision subunits based on Table 5-1 and surface area of the deep zone.

Step 2: The Resident Engineer will divide the deep zone into equal-area subunits based on the number determined in step 1 (refer to Figure 5-1 for example).

Step 3: The Resident Engineer will divide each subunit into three equal-area sampling areas. Where practical, the Resident Engineer will use the random number table, provided in Appendix A, to select four sampling locations for each sampling area from a 16-node, equally spaced two-dimensional grid. For example, the subunit area is 10,000 ft^2, and the dimensions are 100 by 100 ft. A 16-node grid would have a 25-ft spacing in each direction to cover this area. The spacing for other sized sampling areas is derived from the area of the subunit divided by 16. For example, an 800-ft^2 area will have 16 50-ft^2 sampling locations. The staking of the grid will be directed by the Resident Engineer.

Step 4: Collect a grab sample and HPGe data from the four planned locations per sampling area during excavation. If the HPGe data confirm the NaI data, proceed; otherwise, repeat steps 1 through 3 after further excavation, as directed by Resident Engineer.

Step 5: Composite the four grab samples from each sampling area to form three composite samples.

Result: Three composite samples for each decision subunit. Attainment of closeout will be based on statistics calculated for these grab samples in each decision subunit.

5.2.1.2. Contingency B. The excavation surface is not accessible after excavation is complete. Perform steps 1 through 3 **before excavation begins**.

Step 1: The Resident Engineer will plan the expected area of the deep zone **before excavation begins**. The Resident Engineer will determine the number of decision subunits based on Table 5-1 and expected surface area of the deep zone.

Step 2: The Resident Engineer will divide the expected deep zone in equal-area subunits based on the number determined in step 1 (refer to Figure 5-1 for example).

Step 3: The Resident Engineer will divide each subunit in three equal-area sampling areas. Where practical, the Resident Engineer will use the random number table, provided in Appendix A, to select four sampling locations for each sampling area from a 16-node, equally-spaced two-dimensional grid. For example, the subunit area is 10,000 ft^2, and the dimensions are 100 by 100 ft. A 16-node grid would have a 25-ft spacing in each direction to cover this area. The spacing for other sized sampling areas is derived from the area of the subunit divided by 16. For example, an 800-ft^2 area will have 16 50-ft^2 sampling locations.

Although the sampling grid is in two dimensions, the depth of planned sample locations needs to be determined prior to excavation. The staking of the grid will be directed by the Resident Engineer.

Step 4: Collect a grab sample and HPGe data from the four planned locations per sampling area during excavation. If the HPGe data confirm the NaI data, proceed; otherwise, repeat steps 1 through 3.

Step 5: Composite the four grab samples from each sampling area to form three composite samples.

Result: Three composite samples for each decision subunit. Attainment of closeout will be based on statistics calculated for these grab samples in each decision subunit.

5.2.2 Procedures

Follow SOPs found in BHI-EE-01, Environmental Investigations Procedures, for verification sampling. A controlled copy of the referenced procedures will be kept at the field site.

6.0 OVERBURDEN/LAYBACK AND BACKFILL

6.1 Overburden/Layback

The objective for sampling and analyses of overburden and layback is to verify that the suspected clean soil piles do not contain any COCs above remediation levels.

Table 6-1 (derived from SAP *Tables III-2b and III-3*) provides the quality control sampling requirements for overburden/layback sampling. Field split samples should be collected from the same sample as field duplicates.

Table 6-1. Field Quality Control Requirements for Overburden/Layback Sampling.

QC Sample Type	Frequency	Lab
Equipment Rinsates (Blanks)	1 sample per waste site.[a]	QTL
Field Duplicates	5% of all samples or a minimum of 1 sample per sampling unit.[b]	QTL
Field Splits	5% of all samples or a minimum of 1 sample per sampling unit.[b]	SFL
Field Blanks	1 sample per waste site.[a]	QTL
Blind Samples	Determined by Resident Engineer.	QTL

[a] Work sites as described in Section I-1 of the SAP.
[b] Sampling unit is the primary decision unit, such as the overburden/layback, deep zone, or shallow zone.

6.1.1 Frequency/Interval of Measurements

Section III-2 of the SAP summarizes the sample locations, frequencies, and sampling methods to be followed for overburden/layback verification. The sections below describe how to implement the sampling frequencies and sampling methods described in *Table III-2b, Sampling Frequencies and Analytical Methods for Overburden/Backfill and Imported Backfill*, and *Table II-3, Summary of the Default Statistical Design for the Overburden/Layback Decision Units*, of the SAP.

Perform the following steps for overburden/layback verification sampling.

Step 1: The Resident Engineer will determine the number of decision subunits based on Table 5-1 and surface area of the overburden/layback.

Step 2: The Resident Engineer will divide the overburden/layback into equal-area subunits based on the number determined in step 1 (refer to Figure 5-1 for example).

Step 3: The Resident Engineer will divide each subunit into four equal-area sampling areas. Where practical, the Resident Engineer will use the random number table, provided in Appendix A, to select six sampling locations for each sampling area from a 16-node, equally spaced two-dimensional grid. For example, the subunit area is 10,000 ft^2, and the dimensions are 100 by 100 ft. A 16-node grid would have a 25-ft spacing in each direction to cover this area. The spacing for other sized sampling areas is derived from the area of the subunit divided by 16. For example, an 800-ft^2 area will have 16 50-ft^2 sampling locations. The staking of the grid will be directed by the Resident Engineer.

Step 4: Collect HPGe data at each of the six locations in each of the four sampling areas. If the data confirm the NaI detector data, the Resident Engineer will plug this data into the worksheet contained in *Appendix A* of the SAP.

Step 5: The Resident Engineer will calculate the required number of composite samples (which equates to the number of sampling areas) to collect in accordance with the worksheet. If the number of composite samples is greater than the default number of samples (four), the Resident Engineer will follow the procedure in *Appendix A* of the SAP to perform a cost comparison to determine the appropriate number of samples to collect.

Step 6: If it is determined in step 5 more than four composite samples are to be collected, the Resident Engineer will divide each of the decision subunits into the required number of areas (same as number of required samples calculated). Otherwise, the same four sampling areas established in step 3 will be used. Where practical, the Resident Engineer will use the random number table and select four of the six sampling locations selected in step 3. (**Note**: Using four of the six locations, rather than randomly selecting four <u>separate</u> locations, may be useful for correlation data.

Step 7: From the selected four sampling locations in each sampling area, collect a grab sample to form a four-sample composite.

Result: Four (or number determined in step 5) composite samples for each decision subunit, where four locations are sampled for each composite sample. Attainment of closeout will be based on statistics calculated for these composite samples in each decision subunit.

6.1.2 Procedures

Follow SOPs found in BHI-EE-01, Environmental Investigations Procedures, for overburden/layback verification sampling. A copy of the referenced procedures will be kept at the field site.

6.2 Backfill

Acceptance or rejection of soils for backfill material will be based on existing knowledge of the prospective borrow areas. The imported backfill will be radiologically surveyed as a check for suitability for use as clean fill, as described in the sections below.

6.2.1 Analytical Parameters (COCs)

Refer to *Section II.3.1.4, Imported Backfill*, for a discussion on the backfill sampling logic. Radiation surveys with handheld instruments for gross gamma/beta activity will be used to verify that backfill is uncontaminated.

6.2.2 Frequency/Interval of Measurements

Perform radiological surveys of backfill as directed by Resident Engineer.

6.2.3 Procedures

Refer to Table 4.4 of this FIG for field instrument SOPs.

7.0 DATA MANAGEMENT

Refer to *Section II.3.10* of the SAP for a detailed discussion of Data Management requirements. In addition, *Figure II-1, Sample and Data Management Process Flow*, illustrates the data flow requirements.

More specifically, follow EIP 1.5, "Field Logbooks," and provide daily reports of analytical results to Resident Engineer for review and input into the Project-Specific Database.

HEIS numbers will be assigned to all samples analyzed by QTL, SFL, XRF, and HPGe.

8.0 WASTE MANAGEMENT

All waste generated through field sampling and screening will be handled in accordance with the Site-Specific Waste Management Instruction for the Remediation of 100-BC-1, 100-DR-1, and 100-HR-1 Sites.

9.0 REFERENCES

BHI, 1996a, *Field Sampling Quality Management Plan*, BHI-00610, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1996b, *Onsite Measurements Quality Assurance Plan*, BHI-00852, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-01, *Environmental Investigations procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-05, *Field Screening Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-04, *Radiological Control Work Instructions*, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 1996, *100-BC-1, 100-DR-1, and 100-HR-1 Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 0, U.S. Department of Energy, Richland Operations Office., Richland, Washington.

APPENDIX A

SAMPLE GRID LOOKUP TABLE

Table A-1. Sample Grid Point Lookup Table.

Default Plan	Sampling Area 1	Sampling Area 2	Sampling Area 3	Sampling Area 4	Sampling Area 5	Sampling Area 6	Sampling Area 7	Sampling Area 8	Sampling Area 9	Sampling Area 10
HPGe/Closeout	3	6	1	4	5	1	3	3	4	16
HPGe/Closeout	4	7	11	3	15	15	5	13	10	10
HPGe/Closeout	16	3	2	7	7	10	11	4	3	14
HPGe/Closeout	10	15	4	12	1	13	4	8	16	4
HPGe	2	14	5	9	13	12	8	2	14	8
HPGe	13	10	9	13	2	16	1	12	5	3
Not sampling	6	1	10	8	14	4	16	5	8	6
Not sampling	1	9	13	1	10	5	12	1	1	15
Not sampling	9	12	7	5	6	2	6	7	15	9
Not sampling	15	16	15	14	16	6	2	15	11	1
Not sampling	8	13	8	10	12	11	13	14	2	12
Not sampling	5	2	3	11	4	3	9	10	7	11
Not sampling	7	11	14	15	11	14	14	6	13	2
Not sampling	11	4	6	2	9	7	7	11	9	7
Not sampling	12	8	16	16	3	8	15	9	6	13
Not sampling	14	5	12	6	8	9	10	16	12	5

**NOTE: Grid nodes for each sampling area in each waste site should be numbered consistently, e.g., begin numbering the nodes in the northwesternmost node. Then number consecutively left to right as shown in Figure 5-1 of this FIG.

APPENDIX B

ADDITIONAL INFORMATION AND CONTAMINANTS OF CONCERN FOR SITES NOT DISCUSSED IN THE SAMPLING ANALYSIS PLAN

B.1 1607-D2 SEPTIC TANK SYSTEM

The 1607-D2 Septic Tank system is located in the 100-D area approximately 50 ft south of the 116-D-7 Retention Basin. The septic tank and downstream header box supported 100-D Area sanitary and laboratory facilities. It is not known if the septic system received radioactive or hazardous wastes; however, the septic system supported facilities where these materials were routinely used.

During March 1996, investigative sampling of the tank and header box were performed to determine if remediation is required. The septic tank was observed to be approximately one-half full of liquid sewage. The header box was nearly empty. TCLP results were below dangerous waste toxicity characteristic thresholds. However, total metals results indicated levels of lead (Pb), mercury (Hg), and total chromium (Cr) exceeding MTCA B default values. Three samples from the septic tank yielded results for bis(2-ethylhexyl)phthalate greater than the MTCA B default value for protection of groundwater (625 μg/kg). The three results were 5,800, 5,800, and 7,300 μg/kg. The associated laboratory blank contained no detects of bis(2-ethylhexyl)phthalate (the detection limit was 330 μg/kg). Two samples contained concentrations of Europium-152 that exceed a dose rate of 15mrem/yr, the remedial action goal for radionuclides. Because of the detections, the contaminants discussed will be added to the COC list for the 1607-D2 Septic Tank. See Table B-1. Reference IOM# 034615, Group 2 investigation results dated July 26, 1996.

B.2 116-DR-9 RETENTION BASIN

The 116-DR-9 Retention Basin held cooling water effluent from the 105-D/DR Reactors for decay and thermal cooling before release to the Columbia River. Additionally, the basin received cooling water contaminated with ruptured fuel elements. Sampling analytical results from the 100-DR-1 Limited Field Investigation performed in 1991 indicated that bis(2-ethylhexyl)phthalate was detected in two samples at concentrations greater than the MTCA B default value for protection of groundwater (625 μg/kg). These two samples were collected from a vadose zone borehole between 30 ft and 37.5 ft below ground surface. Research of available data and historical information was performed to determine if the reported values of the bis(2-ethylhexyl)phthalate (4,800 μg/kg and 5,200 μg/kg) were valid. The following summarizes the findings:

- The bis(2-ethylhexyl)phthalate results exceeding MTCA B default values were found in two samples from the 199-D8-66 borehole, which was reported in the *Limited Field Investigation Report for the 100-DR-1 Operable Unit* (DOE-RL 1994) as the 116-DR-9C LFI borehole. The sample results are shown below:

  Sample B018D1: 4,800 μg/kg, sample depth 29.9 - 32.7 ft below ground surface
  Sample B018D2: 5,200 μg/kg, sample depth 34.7 - 37.5 ft below ground surface

- *The Qualitative Risk Assessment for the 100-DR-1 Source Operable Unit* (WHC 1994) (QRA), Appendix G, Data Assessment Based on Laboratory and Field Blanks, was reviewed for bis(2-ethylhexyl)phthalate. It was concluded after this review that the QRA was invalid in determining that the result from sample B018D1 was undetected because it was ≤10 times the associated laboratory blank result (sample B018D2 was not included in the QRA data assessment).

  The highest laboratory blank reported in the QRA (490 μg/kg) was not the laboratory blank associated with sample B018D1. The laboratory report containing the results for both B018D1 and B018D2 and the corresponding laboratory blank was obtained from ERC Sample Management. The associated laboratory blank contained no detects of bis(2-ethylhexyl)phthalate (the detection limit was 330 μg/kg). Therefore, the results of samples B018D1 and B018D2 cannot be written off as laboratory contamination.

- Butylbenzylphthalate and di-n-butylphthalate were also found in multiple samples within two LFI boreholes. The concentrations reported do not exceed MTCA B default values. Laboratory blank results corresponding to the samples did not contain phthalates greater than detection (330 μg/kg). Therefore, these samples cannot be written off as laboratory contaminants, and thus, other species of phthalates in addition to bis(2-ethylhexyl)phthalate exist within the 116-DR-9 Retention Basin.

- As discussed in Section B.1, bis(2-ethylhexyl)phthalate was found within the 1607-D2 Septic Tank in concentrations greater than MTCA B default values also. Hanford Site drawing H-1-8547 shows a tile field northeast of the 1607-D2 Septic Tank that was ~70% within the current 116-DR-9 Retention Basin east boundary and ~30% outside the east retention basin boundary. A pipeline is shown running from the septic tank in a northeasterly direction to the southwest side of the tile field. A portion of the tile field was subsequently removed during construction of the retention basin. Ground penetrating radar (GPR) data recently obtained from the area around the 116-DR-9 Retention Basin indicate remnants of the tile field outside the boundary of the retention basin still exist. Therefore, because of the concentrations of bis(2-ethylhexyl)phthalate found in the septic tank and the fact that there used to be a pipeline connecting the septic tank to the tile field where the 116-DR-9 Retention Basin now exists, a source of bis(2-ethylhexyl)phthalate in the area within and near to the 116-DR-9 Retention Basin exists.

After examining the above findings, it has been concluded that bis(2-ethylhexyl)phthalate will be added to the 116-DR-9 COC list because of the following: (1) the detected bis(2-ethylhexyl)phthalate cannot be written off as a laboratory contaminant, (2) a source of bis(2-ethylhexyl)phthalate exists, and (3) the detected bis(2-ethylhexyl)phthalate is greater than MTCA B cleanup levels. See Table B-1.

Table B-1. Contaminants of Concern for Remediating the 1607-D2 and 116-DR-9 Sites.

Site Number	Name	Radiological COC	Chemical COC
1607-D2	Septic Tank	None Identified	Cr (total), Hg, Pb, ^{152}Eu bis(2-ethylhexyl)phthalate
116-DR-9	Retention Basin	^{241}Am, ^{60}Co, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{238}Pu, $^{239/240}Pu$, ^{90}Sr	Cr^{+6}, bis(2-ethylhexyl)phthalate

B.3 REFERENCES

DOE-RL, 1994, *Limited Field Investigation Report for the 100-DR-1 Operable Unit*, DOE/RL-93-29, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WHC, 1994, *The Qualitative Risk Assessment for the 100-DR-1 Source Operable Unit*, WHC-SD-EN-RA-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.